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Changes in very fine root respiration and morphology with time since last fire in a boreal forest

Naoki Makita (1,2), Jukka Pumpanen (3), Kajar Köster (2), and Frank Berninger (2)

(1) Kansai Research Center, Forestry and Forest Products Research Institute, Kyoto, Japan (makita701@gmail.com), (2) Department of Forest Sciences, University of Helsinki, Helsinki Finland, (3) Department of Environmental Sciences, University of Eastern Finland, Kuopio, Finland

We examined the physiological and morphological responses of individual fine root segments in boreal forests stands with different age since the last fire to determine changes in specific fine root respiration and morphological traits during forest succession. We investigated the respiration of fine roots divided into three diameter classes (<0.5, 0.5–1.0, and 1.0–2.0 mm) in a Finnish boreal Pinus sylvestris L. in forest stands with 5, 45, 63, and 155 years since the last fire. Specific respiration rates of <0.5 mm roots in 155-year-old stands were 74%, 38%, and 31% higher than in 5-, 45-, and 63-year-old stands, respectively. However, the respiration rates of thicker diameter roots did not significantly change among stands with respect to time after fire. Similarly, fire disturbance had a strong impact on morphological traits of <0.5 mm roots, but not on thicker roots. Root respiration rates correlated positively with specific root length (length per unit mass) and negatively with root tissue density (mass per unit volume) in all stand ages. The linear regression lines fitted to the relationships between root respiration and specific root length or root tissue density showed significantly higher intercepts in 63- and 155-year-old than in 5-year-old stands. Significant shifts in the intercept of the common slope of respiration vs. morphology indicate the different magnitude of the changes in physiological performance among the fire age class. Despite a specific small geographic area, we suggest that the recovery of boreal forests following wildfire induces a strategy that favors carbon investment in nutrient and water exploitation efficiency with consequences for higher respiration, length, and lower tissue density of very fine roots.